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BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

FOREST INSECT INVESTIGATIONS

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TITLE

FOREST INSECT SURVEY

MODOC NATIONAL FOREST, CALIFORNIA

AND ADJACENT PRIVATE LANDS

SEASON OF 1943

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by

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Forest Insect Laboratory
Berkeley 4, California
June 24, 1944

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U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE
FOREST INSECT INVESTIGATIONS

FOREST INSECT SURVEY
MODOC NATIONAL FOREST, CALIFORNIA
AND ADJACENT PRIVATE LANDS
SEASON OF 1943

Approved by:

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June 24, 1944

ABSTRACT OF RESULTS

THE 1942 BARK BEETLE INFESTATION (Complete records)

Total virgin pine timber killed in the Modoc National Forest, California, and adjacent private lands (Table 2):

Number of trees	17,070
Volume	18,000,000 board feet
Average volume per acre	32.4 board feet
Proportion of virgin pine stand	0.3 board feet

Classification: Endemic

Primary insects: Western pine beetle in ponderosa pine
Jeffrey pine beetle in Jeffrey pine

Trend: Slight decrease over 1941

Control work completed: Infested trees along Klamath Falls - Alturas highway treated by "cut-peel-burn" method or cut and milled.

THE 1943 BARK BEETLE INFESTATION (Incomplete records)

Primary insects: Same as in 1942

Probable trend: Slight increase over 1942 in ponderosa pine
Slight decrease over 1942 in Jeffrey pine

Control work recommended: Reference is made to recommendations made in 1942 for controlling the beetle infestation in the timber screen bordering the Klamath Falls - Alturas highway.

Forest Insect Survey
Modoc National Forest, California
and Adjacent Private Lands
Season of 1943

INTRODUCTION

A survey of the Modoc National Forest and adjacent private lands was made in 1943 by the Berkeley laboratory as part of an annual program to determine the location and extent of damage from insects in this and other important pine forested areas in California. The surveys were first begun in 1922 in what is now known as the Happy Camp-Lava Beds Area and the record of bark beetle infestations built up from succeeding surveys of this area is one of the longest anywhere in the ponderosa pine region. In 1940 the surveys were expanded to include all of the national forest and contiguous timberlands (Figure 1).

The 1943 survey was conducted by J. W. Bongberg and the writer during the period of October 8-20. A 100-percent cruise was made to locate and measure the currently infested trees on 32 roadside strips and three 320-acre plots which together totalled 5,472 timbered acres. This operation completed the record of insect-caused pine losses for 1942 and obtained a partial record of the 1943 losses on the sample strips and plots. The estimates of the loss for the various units were prepared from the strip and plot measurements augmented by general observations except that, in the Warner Mountains Area, the estimates were based wholly upon observations. The measurements were also used to determine the trend of the current bark beetle infestation.

No attempt was made by the survey this year to obtain quantitative estimates of the insect-caused pine mortality on cutover lands except in two small areas where local problems are being studies. All loss estimates appearing in this report are for virgin pine stands as of January 1, 1943. Adjustments in the cutover and virgin acreages corresponding to this date have been made in the report from data received from the McCloud River Lumber Company and the U. S. Forest Service.

THE 1942 BARK BEETLE INFESTATION

Characteristics of the Infestation

As in past years, bark beetles were responsible for nearly all the insect damage to Modoc forests in 1942. Of these, the western pine beetle, Dendroctonus brevicomis Lec., was the most active, killing chiefly mature to overmature high risk ponderosa pines scattered through the stands. In the mixed ponderosa-Jeffrey pine stands in the Adin Area this beetle resumed its dominant place where, the year before, it had been slightly overshadowed by an aggressive Jeffrey

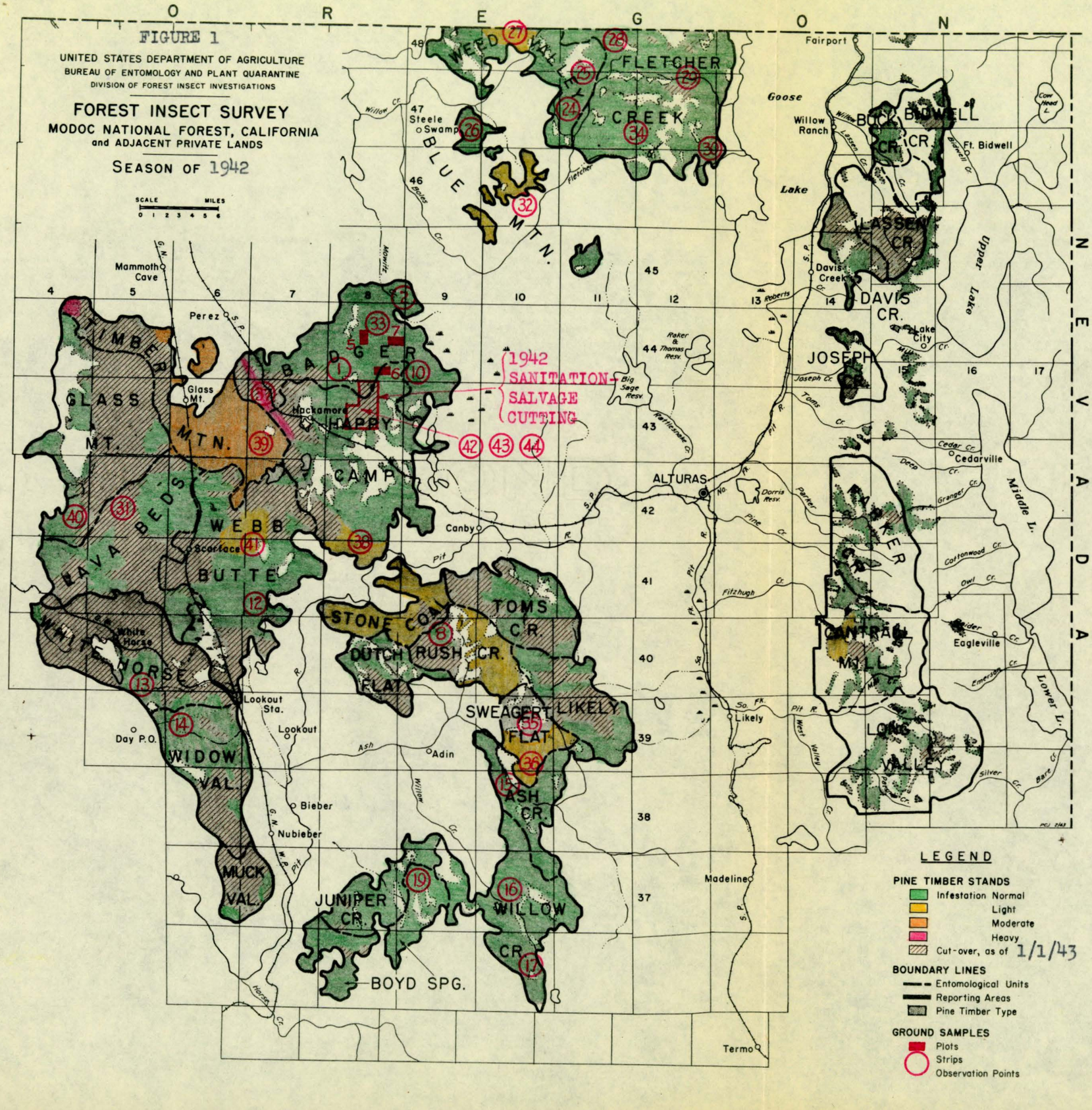
FIGURE 1
UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE
DIVISION OF FOREST INSECT INVESTIGATIONS
FOREST INSECT SURVEY
MODOC NATIONAL FOREST, CALIFORNIA
and ADJACENT PRIVATE LANDS
SEASON OF 1942
SCALE MILES
0 1 2 3 4 5 6
OREGON
NEVADA
1942 SANITATION-SALVAGE CUTTING
WEED VALLEY
FLETCHER CREEK
BLUE MTN.
BADGER
HAPPY CAMP
GLASS MT.
TIMBER MTN.
LAVA BEDS
WEBB
BUTTE
WHITE HORSE
WIDOW VAL.
MUCK VAL.
STONE COY
DUTCH FLAT
TOMS CR.
RUSH CR.
SWEAGERT FLAT
LIKELY
ASH CR.
JUNIPER CR.
WILLOW CR.
BOYD SPG.
BUCK CR.
BIDWELL CR.
LASSEN CR.
DAVIS CR.
JOSEPH CR.
CENTRAL MILL
LONG VALLEY
Upper Lake
Middle L.
Lower L.
Fairport
Goose Lake
Willow Ranch
Ft. Bidwell
Davis Creek
Lake City
Cedarville
Eagleville
Likely
ALTURAS
Canby
Adin
Lookout
Lookout Sta.
Day P.O.
Bieber
Nubieber
Madeline
Termo
Mammoth Cave
Perez
Glass Mt.
Mackamore
Scarface
White Horse
Steele Swamp
Baker & Thomas Resv.
Big Sage Resv.
Dorris Resv.
LEGEND
PINE TIMBER STANDS
Infestation Normal
Light
Moderate
Heavy
Cut-over, as of 1/1/43
BOUNDARY LINES
Entomological Units
Reporting Areas
Pine Timber Type
GROUND SAMPLES
Plots
Strips
Observation Points

pine beetle, D. jeffreyi Hopk., infestation. The Jeffrey pine trees infested by the latter in 1942 were also scattered singly throughout the stands and comprised mature to overmature individuals. There was some tendency for the Jeffrey pine beetle to show less selection between low and high risk trees than did the western pine beetle as judged by the relatively large percentage of infested Jeffrey pines of seemingly low risk. Most of the infested trees of both species appeared to have been killed outright by a single brood of beetles as very few partially infested trees - "top kills" or "strip kills" - were seen. Severe lightning storms which occurred some time between the 1942 and 1943 insect surveys damaged a number of trees of all risk classes and these promptly became infested by bark beetles.

The 1942 bark beetle infestation in ponderosa pine was the lowest in the Happy Camp-Lava Beds Area since the surveys were begun there in 1922. The trend has been mostly downward following the peak of the last epidemic in 1934 (Figure 2), but in 1941 and 1942 it levelled off to presage, perhaps, another period of increasing infestations. This belief is based to some extent upon the presence in the stands of many high risk pine trees and the fact that the susceptibility ratio of these and other trees may be increased by a return of adverse climatic factors. A comparison between the trend in the Happy Camp-Lava Beds Area and the Modoc National Forest as a whole shows some similarity, at least insofar as ponderosa pine is concerned; though the record for the forest as a whole is as yet too short to show a conclusive relationship.

Gross Pine Mortality

1. On virgin sample strips and plots.

The volume of ponderosa pine killed on the sample strips and plots by the western pine beetle in 1942 (Table 1) averaged 32 board feet per acre as compared to 30 in 1941, while the amount of Jeffrey pine killed by the Jeffrey pine beetle decreased from 33 board feet per acre in 1941 to 15 board feet in 1942. The low infestation rate made it difficult to compare the losses on individual samples which, in some cases, ranged from no infested trees at all to a maximum of 18 per 160 acres. In a few instances, however, the quantitative loss over comparatively large areas was believed to have been directly indicated by the measured loss on individual strips within the areas. Two samples (RD-13, RD-14) in the Big Valley Mountain Area were consistent in high-lighting the relatively heavy western pine beetle infestation in that area and, likewise, the heavy damage caused by this beetle in the narrow strip of timber bordering the Klamath Falls-Alturas highway was clearly portrayed by a single strip (RD-37) which sampled 16 percent of the critically infested area.

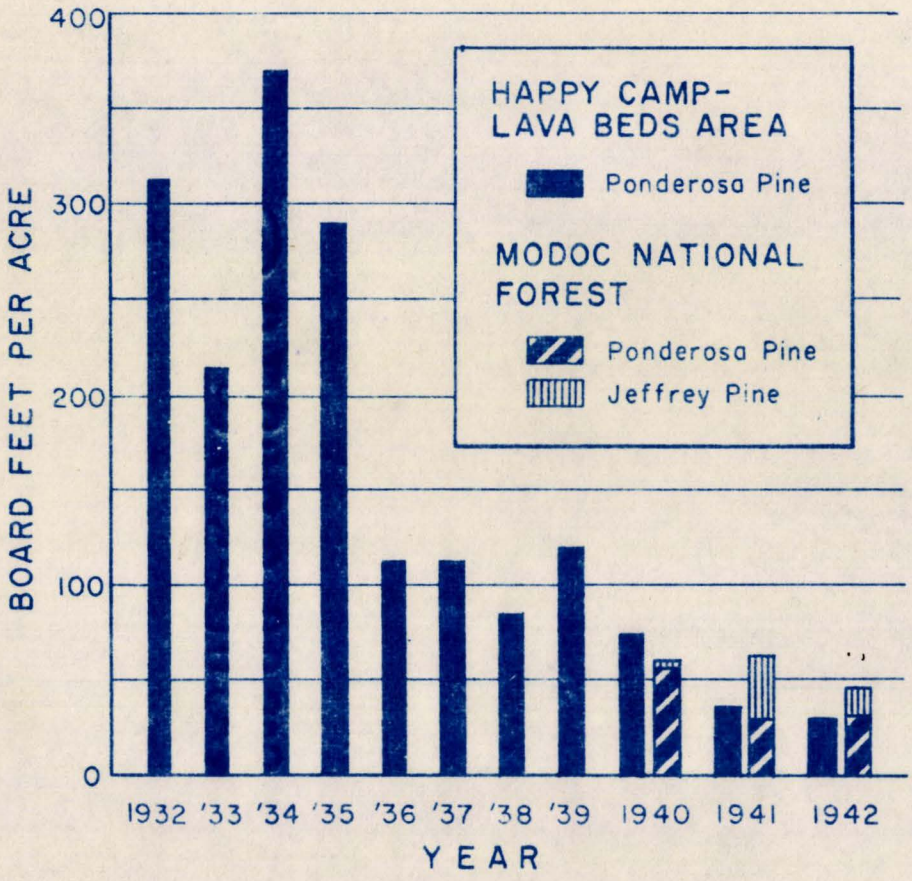

Figure 2. Trend of bark beetle infestations in the Happy Camp-Lava Beds Area (1932-1942) and the Modoc National Forest (1940-1942). A breakdown has been made to show separate trend records for ponderosa and Jeffrey pine since the bark beetle species attacking these two tree species do not necessarily follow similar infestation patterns.

Table 1 - Pine timber killed by bark beetles on virgin sample strips and plots, Modoc National Forest, California, and adjacent private lands. Season of 1942

ENTOMOLOGICAL UNIT	STRIP OR PLOT NO.	TIMBERED ACREAGE	HAZARD RATING	PINE STAND TREE SPP.	PINE STAND VOLUME m.b.m.	TIMBER KILLED IN 1942 NO. OF TREES	VOLUME (b.m.)	VOLUME PER ACRE	% OF STAND
HAPPY CAMP - LAVA BEDS AREA									
Badger	5	300	V	PP	2,000	10	6,730	22.4	0.3
	6	320	IV	PP	3,590	2	1,140	3.6	0.1
	7	300	V	PP	2,490	5	5,490	18.3	0.2
	RD- 1	160	V	PP	2,070	2	1,570	9.8	0.1
	RD- 2	160	IV-V	PP	820	3	3,010	18.8	0.4
	RD-33	160	V	PP	1,120	none	none	none	none
	RD-37	160	V	PP	760	18	21,710	135.7	2.9
Happy Camp	RD-10	160	IV-V	PP	1,850	4	1,310	8.2	0.1
	RD-38	160	IV	PP	1,790	13	12,420	77.6	0.7
Webb Butte	RD-12	160	III	PP	2,360	3	2,800	17.5	0.1
	RD-41	128	IV	PP	1,570	7	9,550	74.6	0.6
Glass Mt.	RD-40	160	III	PP	2,940	2	5,460	34.1	0.2
				SP	910	none	none	none	none
				Total	3,850	2	5,460	34.1	0.1
Timber Mt.	RD-39	160	V	PP	360	2	3,440	21.5	1.0
DEVILS GARDEN AREA									
Weed Valley	RD-24	160	IV	PP	1,750	4	3,330	20.8	0.2
	RD-25	160	III	PP	1,970	6	8,290	51.8	0.4
	RD-27	160	IV	PP	1,430	5	6,770	42.3	0.5
Fletcher Creek	RD-28	160	III	PP	2,790	4	8,210	51.3	0.3
	RD-29	160	III	PP	3,550	7	16,320	102.0	0.5
	RD-30	160	IV	PP	1,580	4	1,860	11.6	0.1
	RD-34	160	IV	PP	2,040	1	1,220	7.6	0.1
Blue Mt.	RD-26	160	IV	PP	1,710	3	4,110	25.7	0.2
	RD-32	80	IV	PP	480	3	2,630	32.9	0.5
ADIN AREA									
Sweagert Flat	RD-35	80	III	PP	1,990	none	none	none	none
	RD-36	80	III	PP	280	none	none	none	none
				JP	660	7	6,640	83.0	1.0
				Total	940	7	6,640	83.0	0.7
Ash Creek	RD-15	80	IV	PP	380	none	none	none	none
				JP	130	none	none	none	none
				Total	510	none	none	none	none
Willow Creek	RD-16	80	IV	PP	880	2	890	11.1	0.1
				JP	330	none	none	none	none
				Total	1,210	2	890	11.1	0.1
	RD-17	160	IV	PP	490	5	3,060	19.1	0.6
				JP	780	none	none	none	none
				Total	1,270	5	3,060	19.1	0.2
Boyd Spring	RD-19	160	IV	PP	1,790	none	none	none	none
				JP	360	2	2,800	17.5	0.8
				Total	2,150	2	2,800	17.5	0.1
BIG VALLEY MOUNTAIN AREA									
White Horse	RD-13	80	III	PP	1,060	5	5,060	63.2	0.5
				SP	570	none	none	none	none
				Total	1,630	5	5,060	63.2	0.3
Widow Valley	RD-14	160	III	PP	2,320	10	11,660	72.9	0.5
				SP	1,480	1	50	0.3	0
				Total	3,800	11	11,710	73.2	0.3
AVERAGE OF ALL SAMPLES									
				PP 1/				31.9	0.4
				JP 2/				14.8	0.3
				SP 3/				none	none

1/ Average of all plots and strips
2/ Average of strips in Adin Area
3/ Average of strips in Big Valley Mountain Area

2. In virgin pine stands.

The measured losses on the samples played an important role in estimating the beetle-caused pine mortality that occurred during 1942 in the different areas and units (Table 2). Approximately 18 million board feet - 14,370,000 board feet of ponderosa pine and 3,630,000 feet of Jeffrey pine - were killed during the year in the virgin stands of the five reporting areas.

The loss estimates in the various areas show the effect of the rise or decline in the infestation since 1941 and of the decrease in virgin stand acreage due to logging. The 1942 estimates were greater by 137 percent in the Devils Garden Area and by about 45 percent in the Big Valley Mountain Area, due almost entirely to an increase in insect activity. They were less than the 1941 estimates by 53 percent in the Happy Camp-Lava Beds Area, partly because there was less virgin timber by some 18,000 acres in 1942 than there was in 1941, but mostly because the infestation level was 50 percent less in 1942 than the year before. The situation in the Adin and Warner Mountains Areas showed little change in 1942, except for a slight decline of Jeffrey pine losses.

The localized western pine beetle epidemic which developed in 1942 in the narrow timber screen along the Klamath Falls-Alturas highway, and which was discussed in some detail in the 1942 survey report, apparently reacted favorably to direct control measures applied by the Forest Service early in 1943. The following tabulations show the course of the infestation in 1941 before the outbreak, in 1942 during its height and in 1943 following control work.

Amount of ponderosa pine killed	1941	1942	1943 1/
Number of trees per acre	.019	.113	.060
per section	12	72	38
Board-foot volume per acre	41.6	135.7	67.5
per section	26,624	86,848	43,200
Percent of pine stand (by Volume)	0.9	2.8	1.4

1/ Estimated for full calendar year.

The control work apparently cut down the 1943 losses to about one-half the 1942 amount but not enough to return the infestation to a truly endemic status. This situation serves to point out the risk involved in leaving small islands of mature timber in areas where the beetle hazard is normally very great. It appears evident that vigilance will be required to keep the highway screen from being depleted by beetles.

Table 2 - Estimated virgin pine timber killed in 1942 by bark beetles, Modoc National Forest, California, and adjacent private lands.

ENTOMOLOGICAL UNIT	PINE TYPE ACREAGE (January 1, 1943) Virgin	Cutover	Total	VIRGIN PINE STAND Spp.	M b.m.	PINE TIMBER KILLED 1942 No.of trees	VOLUME M b.m.	b.m./ac.	% stand
HAPPY CAMP - LAVA BEDS AREA									
Badger	48,930	7,370	56,300	PP	331,420	780	570	11.6	0.2
Happy Camp	43,730	13,310	57,040	PP	425,500	1,570	970	22.1	0.2
Webb Butte	36,360	28,770	65,130	PP	503,250	1,160	1,330	36.5	0.3
Lava Beds	30,620	25,400	56,020	PP	298,910	600	600	19.6	0.2
Glass Mtn.	18,330	40,760	59,090	PP	214,790	240	630	34.1	0.3
				SP	38,540	none	none	none	none
Timber Mtn.	36,000	13,030	49,030	PP	80,100	320	510	14.3	0.6
SUB-TOTAL	213,970	128,640	342,610	PP	1,853,970	4,670	4,610	21.0	0.2
				SP	38,540	none	none	none	none
DEVILS GARDEN AREA									
Weed Valley	24,780	-	24,780	PP	260,990	740	1,030	41.6	0.4
Fletcher Creek	55,510	1,930	57,440	PP	725,230	1,390	2,390	43.1	0.3
Blue Mtn.	13,130	-	13,130	PP	100,350	380	380	29.3	0.4
SUB-TOTAL	93,420	1,930	95,350	PP	1,086,570	2,510	3,800	40.7	0.3
WARNER MOUNTAINS AREA									
Bidwell Creek	4,090	1,270	5,360	PP	28,440	40	30	7.3	0.1
Joseph Creek	1,940	1,600	3,540	PP	17,030	40	30	15.5	0.2
Parker Creek	8,550	1,330	9,880	PP	83,030	200	170	19.9	0.2
				JP	20,580	70	80	9.4	0.4
Cantrall Mill	13,620	1,600	15,220	PP	47,550	160	140	10.3	0.3
				JP	85,960	360	430	31.6	0.5
Long Valley	11,960	1,260	13,220	PP	105,000	130	110	9.2	0.1
				JP	34,630	60	70	5.9	0.2
SUB-TOTAL	40,160	7,060	47,220	PP	281,050	570	480	12.0	0.2
				JP	141,170	490	580	14.4	0.4
ADIN AREA									
Dutch Flat	9,470	4,610	14,080	PP	71,810	260	220	23.2	0.3
				JP	19,570	80	100	10.6	0.5
Stone Coal	18,620	2,320	20,940	PP	105,040	490	420	22.6	0.4
				JP	33,940	170	200	10.7	0.6
Toms Creek	16,770	12,410	29,180	PP	189,480	890	760	45.3	0.4
				JP	46,140	190	230	13.7	0.5
Likely	15,170	11,680	26,850	PP	200,380	470	400	26.4	0.2
				JP	65,310	170	200	13.2	0.3
Rush Creek	13,100	5,150	18,250	PP	75,270	350	300	22.9	0.4
				JP	48,750	320	390	29.8	0.8
Sweagert Flat	13,270	200	13,470	PP	102,220	390	310	23.4	0.3
				JP	57,190	780	730	55.3	1.3
Ash Creek	18,710	160	18,870	PP	78,850	240	310	16.6	0.4
				JP	61,870	130	170	9.0	0.3
Willow Creek	32,460	-	32,460	PP	101,660	910	490	15.1	0.5
				JP	143,740	520	570	17.6	0.4
Boyd Spring	19,760	920	20,680	PP	103,340	130	100	5.1	0.1
				JP	65,470	260	350	17.5	0.5
Juniper Creek	14,060	480	14,540	PP	104,410	130	100	7.9	0.1
				JP	19,020	80	100	17.5	0.5
SUB-TOTAL	171,390	37,930	209,320	PP	1132,460	4,260	3,410	19.9	0.3
				JP	561,000	2,700	3,040	17.7	0.5
BIG VALLEY MOUNTAIN AREA									
White Horse	10,340	40,040	50,380	PP	291,130	650	650	63.2	0.2
				SP	156,100	none	none	none	none
Widow Valley	19,350	13,190	32,540	PP	324,630	1,200	1,410	72.9	0.4
				SP	107,500	none	none	none	none
Muck Valley	3,540	8,030	11,570	PP	5,110	10	10	2.8	0.1
				JP	1,370	10	10	2.8	0.5
SUB-TOTAL	33,230	61,260	94,490	PP	620,870	1,860	2,070	62.3	0.3
				SP	263,600	none	none	none	none
				JP	1,370	10	10	0.3	0.5
TOTAL OF ABOVE FIVE REPORTING AREAS	552,170	236,820	788,990	PP	4974,920	13,870	14,370	25.8	0.3
				JP	703,540	3,200	3,630	6.6	0.5
				SP	302,140	none	none	none	none
				PP+JP+SP	5,980,600	17,070	18,000	32.4	0.3

3. In cutover reserve stands.

No evidence of any serious insect damage was observed in pine cutover reserve stands though the survey did not attempt to examine these too minutely. The flare-up of bark beetle activity which occurred in 1941 in the cutover reserve stands just east of the new Long Bell Lumber Company logging camp subsided in 1942 and 1943. The infestation is now down to a level of 14 trees and 8,000 board feet per section (0.5 percent of the residual stand) from its 1941 peak of 68 trees and 25,470 board feet per section (1.7 percent of the residual stand). This outbreak was presumably caused by the presence, in a very high beetle hazard area, of many overmature high risk trees below the merchantable diameter limit left in the reserve stand by the cutting operations in 1940. Those which had not already been killed by beetles were cut and destroyed by the Forest Service in 1942 to prevent a reoccurrence of the outbreak.

4. In stands treated by sanitation-salvage cutting.

The 30 percent sanitation-salvage cutting made in 1942 1/ on nearly 3,000 acres of high hazard pine stands in the Hog Lake Compartment (Figure 1) has thus far been effective in reducing subsequent beetle losses in the treated area. Losses which occurred during the autumn of 1942 following the sanitation-salvage treatment earlier that year averaged 2.6 board feet per acre on the three roadside strips (RD-42, RD-43 and RD-44) set up in the treated area by the 1943 survey. Losses during a similar period on untreated check strips averaged 13.3 board feet per acre. No 1943 losses had occurred on the treated strips up to the time the survey was made.

The above 1942 loss on the treated strips could reasonably be classed as accidental since it was made up of only one tree which had been badly scorched by fire and thus rendered more susceptible to attack by bark beetles. Its death emphasizes the fact that the effectiveness of the beetle control secured from sanitation-salvage treatment may be nullified somewhat by injury to the reserve trees either by natural causes or by carelessness in connection with subsequent woods operations.

1/ Bongberg, Jack W. Selective cutting for the prevention of timber loss caused by insects, Hog Lake Compartment, Happy Camp-Lava Beds Area, Modoc National Forest, California. Report of the Forest Insect Laboratory, Berkeley, California. January 1, 1943.

INSECT DAMAGE CAUSED IN 1943

Pine Bark Beetles

On the basis of that portion of the 1943 losses measured by the survey, it appears that the ponderosa pine losses for the entire year will register no change or, at most, only a slight increase over 1942 and that Jeffrey pine losses will even be lower in 1943 than in 1942. The 1943 infestation was similar in character to the 1942 infestation and no "hot spots" had appeared up to the time of the survey and none have been reported to the laboratory since then.

Great Basin Tent Caterpillar

One of the most devastating epidemics of the Great Basin tent caterpillar, Malacosoma fragilis Stretch, to occur in recent years struck the Modoc country during the early summer of 1943. Defoliation of bitterbrush, Purshia tridentata DC, the principal host, was very heavy, particularly near Badger Well, where it amounted to 100 percent of the crown surface of all the plants. So numerous were the caterpillars during June that they overflowed to other plants which normally are not molested. Among these were greenleaf manzanita, Arctostaphylos patula Greene; slickleaf or snow bruch, Ceanothus velutinus Dougl.; and even mountain mahogany, Cercocarpus ledifolius Nutt. The loss of vitally needed forage was keenly felt by stockmen who normally range large bands of sheep in this territory during the summer months. A late fall examination of the bitterbrush showed that many of the plants had not succumbed and that they had begun to put out a second crop of leaves.

Jeffrey Pine Cone Moth

The infestation of the cone moth, Laspeyresia sp., reported two years ago is still active in the Jeffrey pine stands in the Adin Area. Samples of maturing cones taken at various points showed more than half to be infested. About one-third to one-half the Jeffrey pine seed crop is believed to have been destroyed in 1943 by the moth. No feasible method has been devised for controlling this infestation over large forest areas so it is hoped that natural factors may combine to eventually overcome it.

INSECT CONTROL RECOMMENDATIONS

There does not appear to be any need of direct control action anywhere in the Modoc at the present time with the possible exception of the situation along the Klamath Falls-Alturas highway. The difficulties of keeping bark beetles out of the narrow strip of timber along the

highway were emphasized in the 1942 forest insect survey report of this laboratory 1/ together with detailed discussion of measures which might be taken toward accomplishing this. The Forest Service has already begun a long-term protection plan for the strip based upon these recommendations with the aim of at least slowing down the losses if they cannot be prevented altogether.

It is encouraging to note the real effort being made by the Modoc National Forest to decrease perennially heavy beetle losses by widespread use of sanitation-salvage cuttings made in conjunction with the sale of government-owned stumpage. Experience thus far has shown that logging conditions are ideal in the Modoc country for this type of selection cutting and that such operations are entirely justifiable in terms of the quality and quantity of the timber cut and the beetle control results secured.

1/ Johnson, Philip C. and Charles B. Eaton. Forest insect survey, Modoc National Forest, California, and adjacent private lands. Season of 1942. Report of the Forest Insect Laboratory, Berkeley, California. April 3, 1943.